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(54) **DEVICES FOR MEDICAL PROCEDURES
AND RELATED METHODS OF USE**

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A61B 17/221 (2006.01)
A61B 1/00 (2006.01)

(52) **U.S. Cl.**

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(2013.01); **A61B 2017/003** (2013.01); **A61B**
2017/0046 (2013.01); **A61B 2017/00367**
(2013.01)

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2025/09116

See application file for complete search history.

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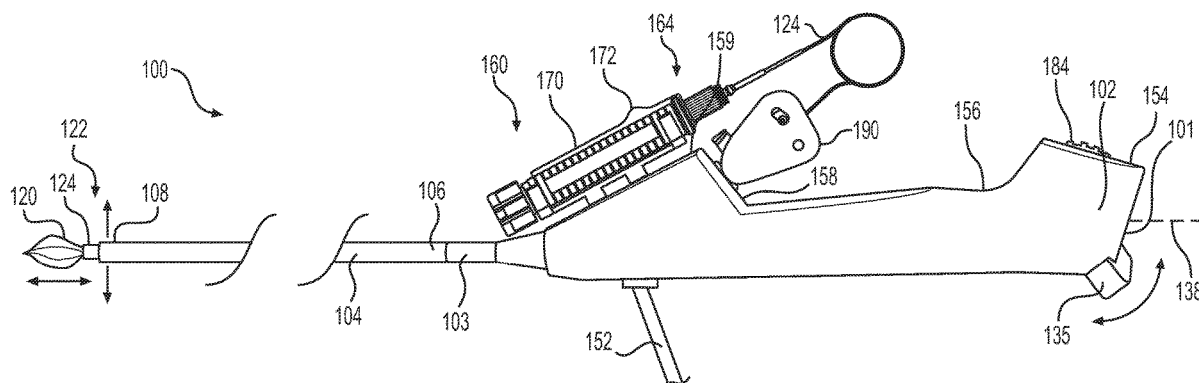
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(57) **ABSTRACT**

A medical device may include a handle having an actuator,
and a shaft coupled to the handle. The shaft may include a
working channel. The medical device also may include a
pair of friction rollers configured to be actuated by the
actuator. The pair of friction rollers may be configured to
receive an elongate member between one another, wherein
actuation of the actuator may cause the pair of friction rollers
to rotate and urge the elongate member to translate.

3 Claims, 5 Drawing Sheets



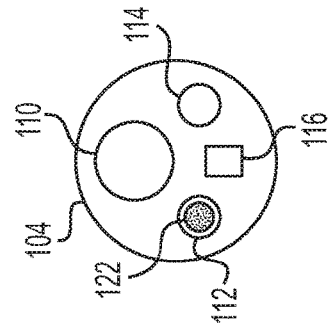
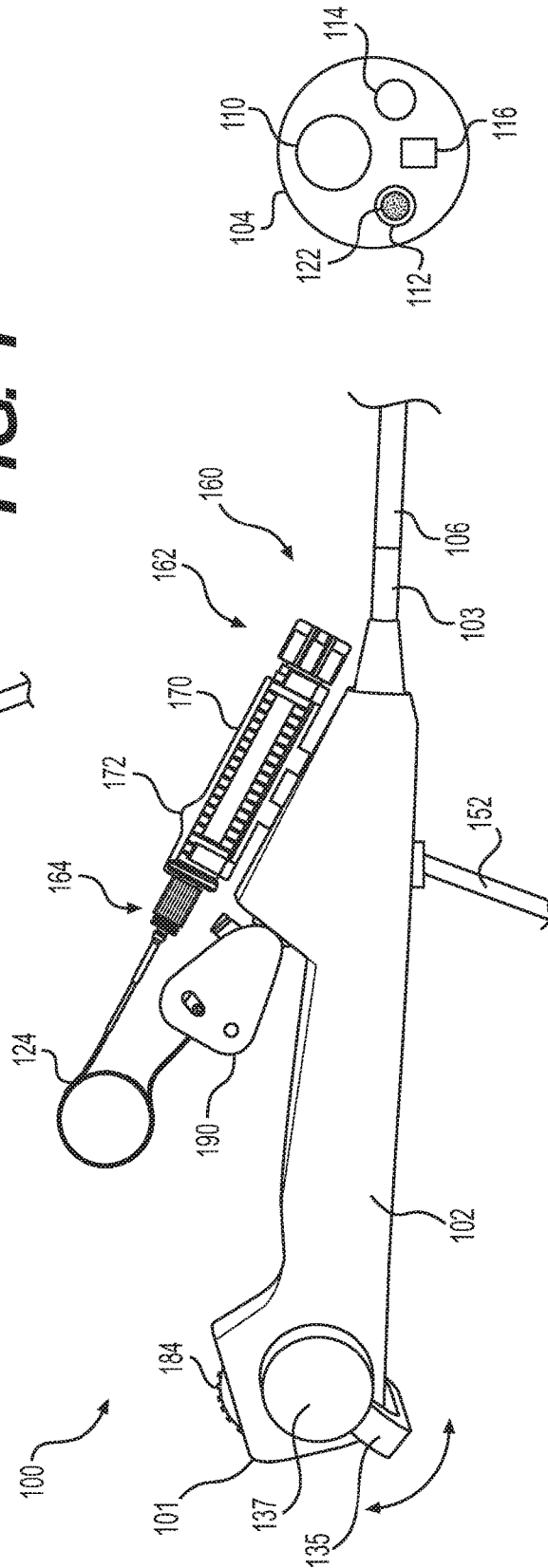
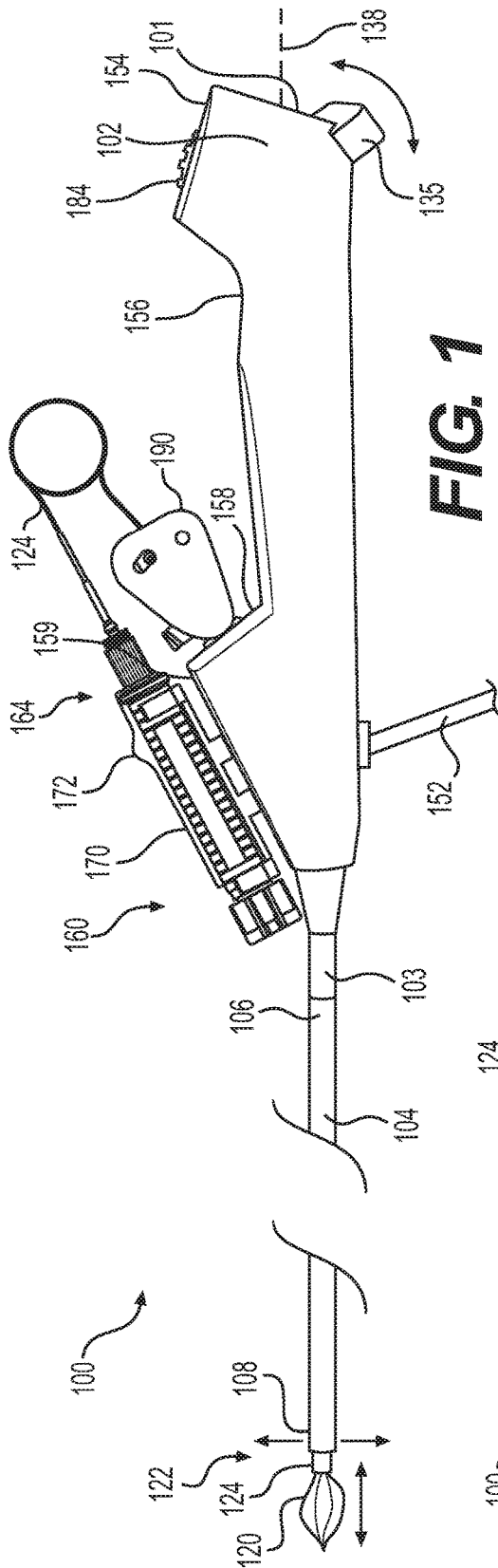


FIG. 3

FIG. 2

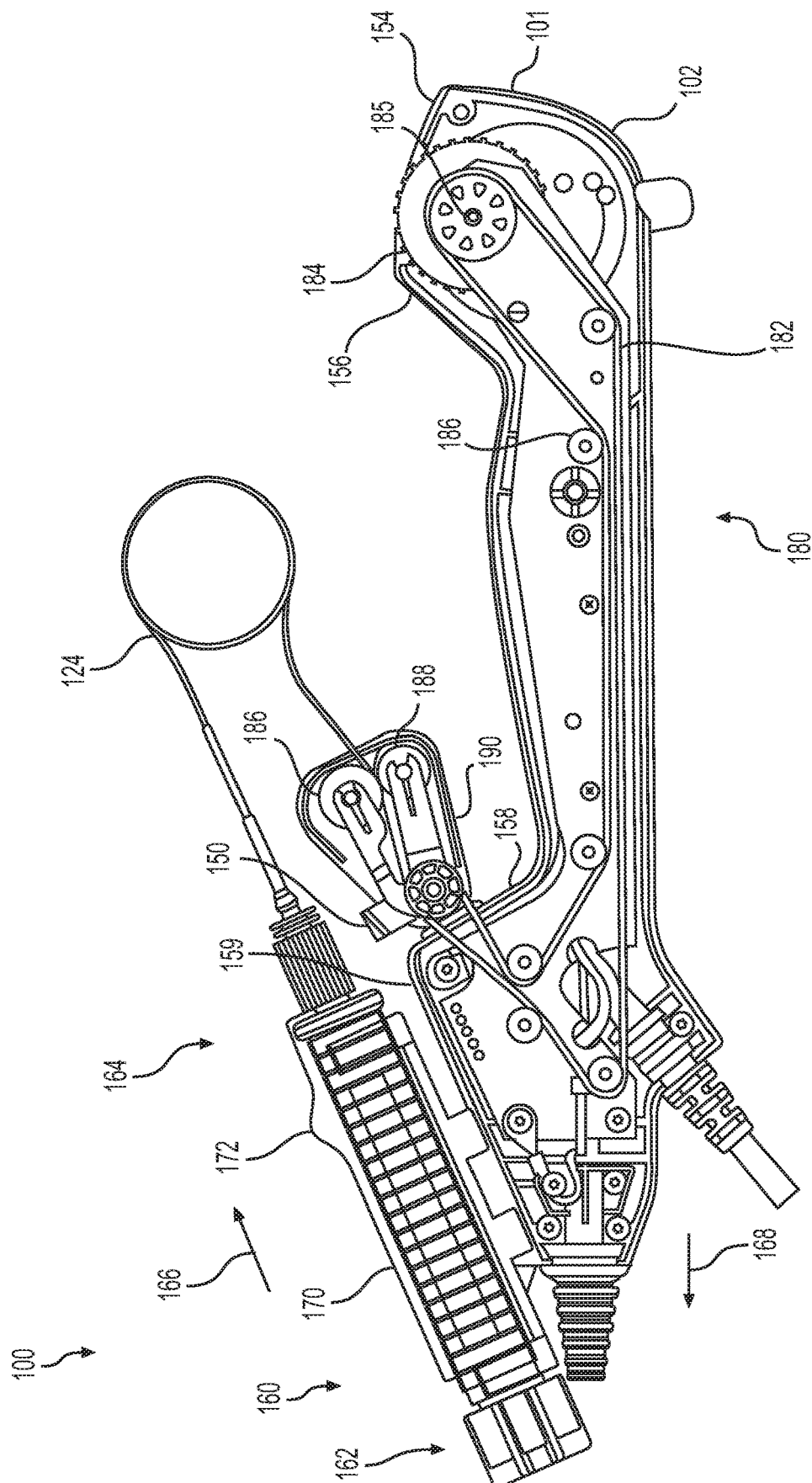


FIG. 4

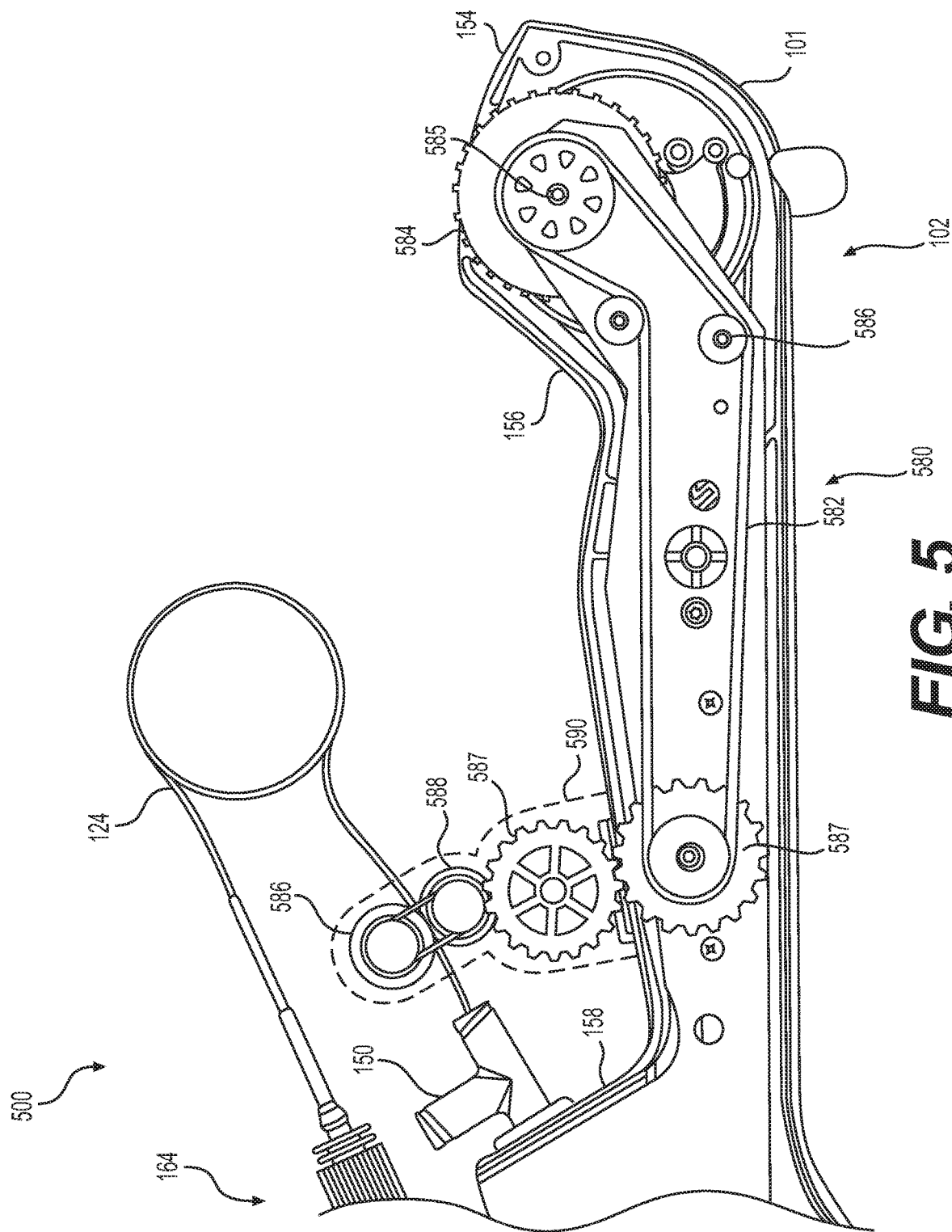
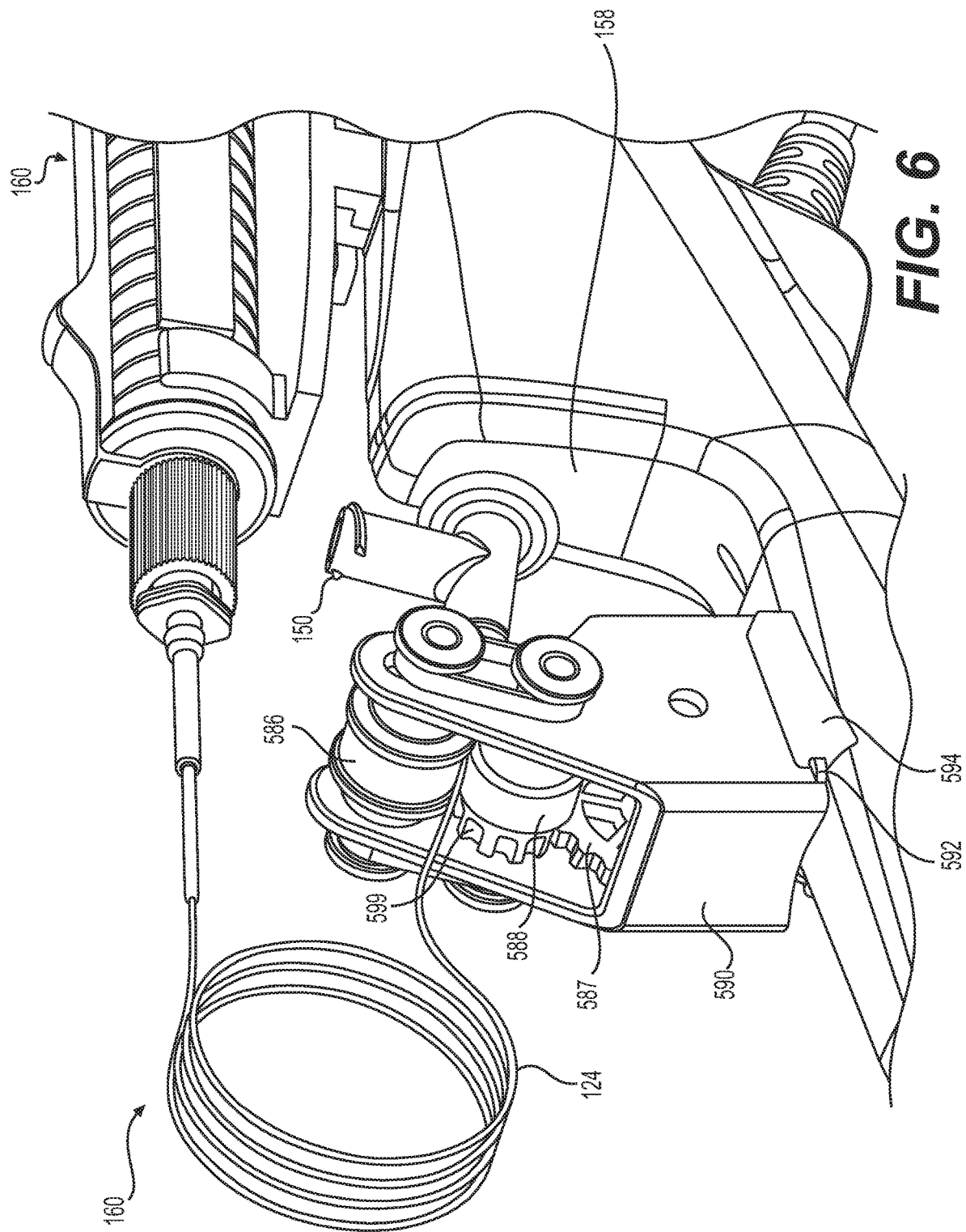
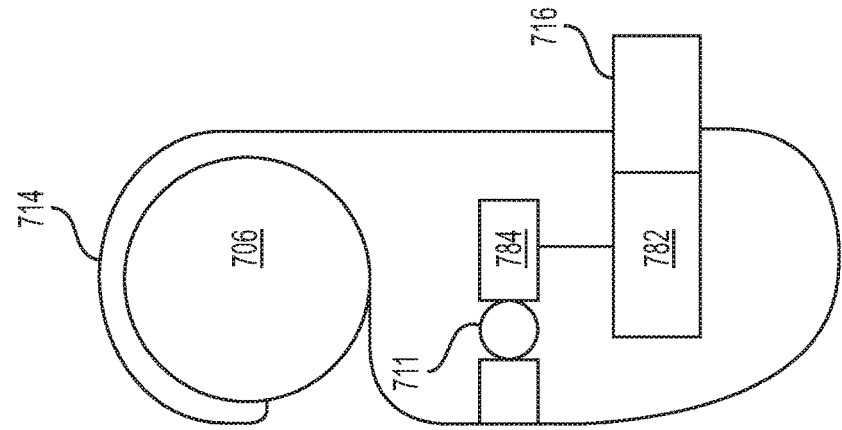
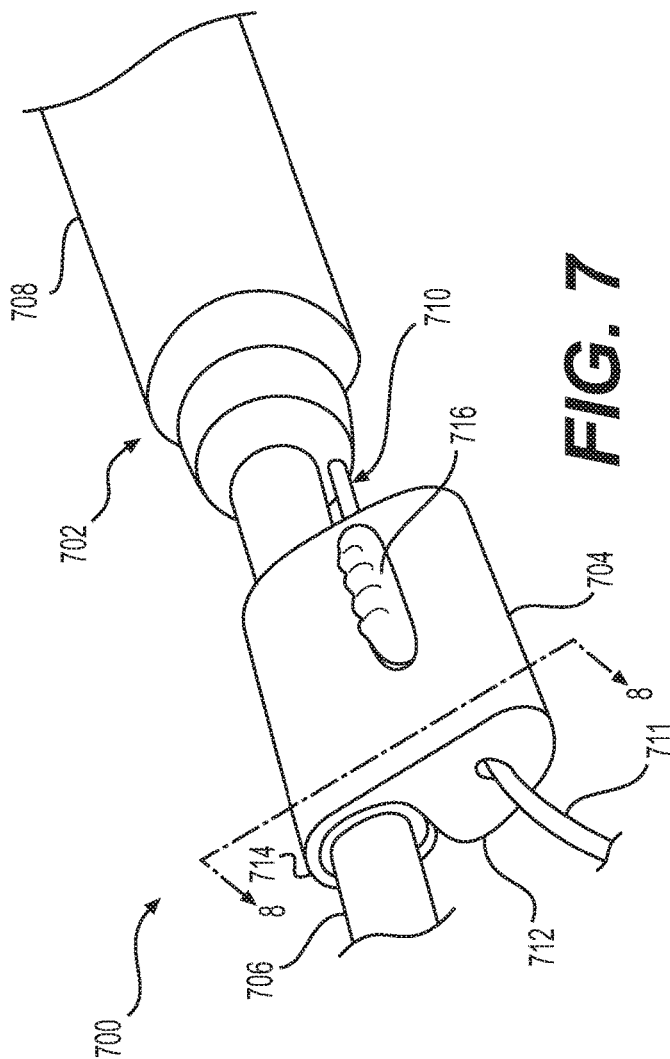


FIG. 5





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DEVICES FOR MEDICAL PROCEDURES AND RELATED METHODS OF USE

CROSS-REFERENCE TO RELATED APPLICATION(S)

This patent application claims the benefit under 35 U.S.C. § 119 to U.S. Provisional Patent Application No. 62/288,625, filed on Jan. 29, 2016, the entirety of which is incorporated herein by reference.

TECHNICAL FIELD

Various aspects of the present disclosure relate generally to medical devices. More specifically, the present disclosure includes medical devices with mechanisms for controlling the longitudinal movement of tools through endoscopic devices, and related methods of use.

BACKGROUND

Retrieval devices and systems allow physicians and other medical professionals to remove various materials from a patient, including organic material (e.g., blood clots, tissue, and biological concretions such as urinary, biliary, and pancreatic stones) and inorganic material (e.g., components of a medical device or other foreign matter). For example, concretions can develop in the kidneys, pancreas, ureter, or gallbladder, and cause blockages or other complications within the body. Minimally-invasive medical procedures may be used to remove these materials through a natural orifice, such as lithotripsy and ureteroscopy, or through an incision, such as percutaneous nephrolithotomy.

Current endoscopic systems have disadvantages, however. For example, ureteroscopy procedures typically require two or more people, wherein a physician controls the ureteroscope with both hands (one hand to grasp the handle and the other to hold the distal portion of the ureteroscope as it enters the urinary tract via the urethral meatus), and an assistant inserts a tool such as a basket, forceps, or a laser through a working channel of the ureteroscope and manipulates the tool. To remove a kidney stone, for example, a ureteroscope is used to gain access to the kidney, and a separate basket device is inserted into the working channel of the ureteroscope to remove or reposition the stone. In order to fragment larger stones into smaller pieces for removal, the basket device can be withdrawn from the working channel and substituted for a laser. After fragmenting the stone, the laser can be removed from the working channel and the basket device reinserted to capture the fragments.

This technique requires careful coordination. If communication between the physician and assistant is unclear, the assistant may require multiple attempts to successfully fragment and retrieve a stone or other material from the patient. Multiple attempts can increase risk to the patient, increase procedure time, and lead to tool damage for repeated unsuccessful attempts. Further, coordination between multiple people to control separate instruments simultaneously in a limited space can be logistically difficult and inconvenient, requiring awkward gripping and imprecise manipulation of the instruments.

SUMMARY

In one aspect, the present disclosure is directed to a medical device that may include a handle having an actuator,

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and a shaft coupled to the handle. The shaft may include a working channel. The medical device also may include a pair of friction rollers configured to be actuated by the actuator. The pair of friction rollers may be configured to receive an elongate member between one another, wherein actuation of the actuator may cause the pair of friction rollers to rotate and urge the elongate member to translate.

Actuation of the actuator may cause a first friction roller of the pair of friction rollers to rotate in an opposite direction from a second friction roller of the pair of friction rollers. Rotation of the actuator in a first direction may cause the elongate member to move distally. Rotation of actuator in a second direction that is opposite of the first direction may cause the elongate member to move proximally. The medical device may include a translation system coupling the actuator to the pair of friction rollers, wherein the translation system may be configured to use a rotational force applied to the actuator to cause the pair of friction rollers to rotate. The translation system may include an endless belt coupled to both the actuator and to the pair of friction rollers. The endless belt may be tensioned such that the relative position of elongate member and the pair of friction rollers is fixed when no force is applied to the actuator. The actuator may be a rotatable thumbwheel, wherein the outer surface of the handle may include a thumbwheel surface at a proximal end of the handle, and wherein the thumbwheel may extend through the thumbwheel surface. The medical device may further include a gripping portion extending distally from the thumbwheel surface, and an access surface extending distally and radially outward from the gripping portion, wherein the access surface includes a port coupled to the first working channel. The medical device may further include a translation housing coupled to the access surface, wherein the pair of friction rollers may be disposed in the translation housing. The medical device may further include a mounting surface offset from and extending distally from the access surface, the mounting surface including one or more mating features configured to receive a tool handle assembly. The medical device may further include a translation housing coupled to the gripping portion, wherein the pair of friction rollers may be disposed in the translation housing. The translation housing may further include a mating flange, and wherein the gripping portion may include a mating feature configured to receive the mating flange. The pair of friction rollers may be biased toward one another. Each of the pair of friction rollers may include a rubber material disposed around its respective circumference, wherein the rubber material of a first friction roller of the pair of friction rollers may contact the rubber material of a second friction roller of the pair of friction rollers.

In yet another aspect, the present disclosure is directed to a medical device that may include a handle having a thumbwheel that extends through an outer surface of the handle, and a shaft coupled to the handle, the shaft including a working channel. The medical device also may include a sheath disposed through the working channel, and a tool disposed through the sheath and movable relative to the sheath. The medical device also may include a tool handle assembly mounted to the handle, the tool handle assembly having an actuator configured to move the tool relative to the sheath, and a pair of friction rollers configured to be actuated by the thumbwheel, wherein the pair of friction rollers may receive the sheath between one another, and wherein rotation of the thumbwheel may cause the pair of friction rollers to rotate and urge the sheath and the tool to move through the working channel.

The tool may be an expandable basket. Rotation of the thumbwheel in a first direction may cause the sheath and the tool to move distally together, and wherein rotation of actuator in a second direction that is opposite of the first direction may cause the sheath and the tool to move proximally together.

In yet another aspect, the present disclosure is directed to a method of performing a medical procedure. The method may include positioning an elongate member through a working channel of an endoscopic device, and positioning the elongate member adjacent at least one friction roller. The method also may include rotating a thumbwheel to cause the at least one friction roller to rotate and urge the elongate member through the working channel.

The thumbwheel and the at least one friction roller may be disposed within a translation device, wherein the method may further include securing the translation device to a rigid shaft of the endoscopic device.

BRIEF DESCRIPTION OF THE FIGURES

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate various examples and together with the description, serve to explain the principles of the disclosure.

FIG. 1 is a side view of a medical device according to an example of the present disclosure.

FIG. 2 is another side view of the medical device of FIG. 1.

FIG. 3 is a distal end view of the medical device of FIG. 1.

FIG. 4 is a side view of the medical device of FIG. 1, with portion of the medical device cutaway.

FIG. 5 is a side view of a medical device according to another example of the present disclosure, with a portion of the medical device cutaway.

FIG. 6 is a perspective view of the medical device of FIG. 5.

FIG. 7 is a perspective view of a medical device according to another example of the present disclosure.

FIG. 8 is an end view of a portion of the medical device of FIG. 7.

DETAILED DESCRIPTION

Examples of the present disclosure include medical devices useful in diagnostic and/or treatment procedures, such as breaking apart and retrieving autogenous materials and/or foreign materials from a patient. Medical devices according to the present disclosure may provide for a single operator to have longitudinal and/or rotational control of tools used in the diagnostic and/or treatment procedures.

An exemplary medical device 100 according to some aspects of the present disclosure is shown in FIGS. 1-4, comprising a handle 102 coupled to a shaft 104. The medical device 100 may be suitable for use in ureteroscopy, for example, but may be configured for use in other procedures and for diagnosis/treatment of other areas of a patient's body. The handle 102 may have any shape suitable for gripping and controlling the medical device 100, and may extend from a proximal end 101 toward a distal end 103. For example, the handle 102 may have an ergonomic shape designed to be held comfortably in the hand, e.g., the palm of the hand. The shaft 104 may extend from a proximal end 106 to a distal end 108, such that the proximal end 106 of the shaft may be coupled to (e.g., detachably or permanently

connected to) the distal end 103 of the handle 102. The handle 102 and/or the shaft 104 may be disposable.

The medical device 100 may include a steering mechanism for deflecting the shaft 104 along one or more planes. For example, the handle 102 may include an actuator 135 coupled to one or more portions of the shaft 104 at or near the distal end 108 of the shaft 104 via one or more control members, such as steering wires (not shown). Any suitable steering mechanism and/or actuators may be used. The actuator 135 may be pivotably coupled to the handle 102 via a post 137, as shown in FIG. 2, such that pivoting the actuator 135 about the post 137 moves the distal end 108 of the shaft 104 along a plane (e.g., left/right or up/down). That is, pivoting actuator 135 about post 137 may deflect the distal end 108 of the shaft 104 away from or toward a longitudinal axis 138 of the medical device 100. According to some aspects, the actuator 135 may include a locking device, such that the actuator 135 may be locked in place when the distal end 108 of the shaft 104 is in a desired position.

The shaft 104 may include at least one working channel, for example three working channels 110, 112, 114 as shown in cross-section in FIG. 3. According to some aspects, the medical device 100 may include two working channels (e.g., only working channels 110 and 112, or 110 and 114), or may include more than three working channels. Further, the working channels may have different shapes and/or sizes. For example, working channel 110 of FIG. 3 as shown is relatively larger than the other two working channels 112, 114, e.g., such that working channel 110 may serve as a main working channel 110. In some examples, the shaft 104 may include one or more electronic components 116, such as a camera or other imaging device, a light source, and/or other sensor. For example, the shaft 104 may include a camera lens ranging from about 0.5 mm² to about 2 mm² in size, or from about 0.75 mm² to about 1.5 mm² in size, e.g., approximately 1 mm² in size. Additionally or alternatively, one of the working channels 110, 112, 114, may provide a lumen for light delivery. For examples comprising a steering mechanism, the shaft 104 may include control channels (not shown) to house the steering control members.

In some aspects of the present disclosure, the handle 102 may include at least one port 150 (e.g., a luer port) in communication with one or more of the working channels 110, 112, 114, e.g., to allow for the insertion of tools (e.g., forceps, scissors, a grasper, a snare, a probe, a guidewire, a laser, an optical device, an imaging device), for irrigation, and/or for suction. For example, irrigation may be pumped through one or more of the working channels, e.g., working channel 110 and/or working channel 112, via the port 150 to provide lubrication and/or aid in visualization. The handle 102 may include an electronics hub or connector 152 for electrical connections, such as transferring data and/or powering a light source.

Further referring to FIG. 3, at least one of the working channels (or according to some aspects of the present disclosure, the only working channel), e.g., channel 112, may house a tool 122 configured to translate proximally and distally, such that the tool 122 may exit the distal end 108 of the shaft 104 for performing a procedure. Tool 122 may extend through a sheath 124. Tool 122 and sheath 124 may be configured to move together through channel 112 in some instances, and in other instances, may be moved relative to one another. For example, tool 122 and sheath 124 may be moved together during insertion into and removal from channel 112. Tool 122 and sheath 124 also may be moved together when an operator desires to adjust the longitudinal

position of tool **122** when deployed inside the body. Tool **122** and sheath **124** may be moved relative to one another by when an operator desires to deploy tool **122**, and also when an operator desires to collect the tool **122** after it is used.

Handle **102** may include a thumbwheel surface **154** at proximal end **101**. The thumbwheel surface **154** may extend radially outward from the longitudinal axis **138** in the distal direction. Handle **102** may include a gripping portion **156** that extends from thumbwheel surface **154**. Gripping portion **156** may extend distally from thumbwheel surface **154** and may include a plurality of surfaces arranged to create an ergonomic grip for the operator. An access surface **158** may extend distally and radially outward from the distalmost surface of gripping portion **156**, and a mounting surface **159** may extend distally from access surface **158**. Access surface **158** may be offset from longitudinal axis **138** of medical device **100**, and mounting surface **159** may be offset from both access surface **158** and longitudinal axis **138**.

FIGS. **1**, **2**, and **4** illustrate a tool handle assembly **160** mounted to the mounting surface **159** of medical device **100**. Tool handle assembly **160** may extend from a proximal end **162** toward a distal end **164**. Tool handle assembly **160** may be oriented in a generally inverse configuration with respect to handle **102** such that tool handle assembly **160** extends distally along a first direction **166**, while handle **102** extends distally in a second direction **168** that generally opposes the first direction **166**. Tool handle assembly **160** may include an actuator **170** such as, e.g., a sliding mechanism, rotating mechanism, pushing mechanism, or the like. In the examples shown in FIGS. **1**, **2**, and **4**, actuator **170** may include a protrusion **172** on its upper surface, on which the user may exert forces on actuator **170** using his or her thumb. Actuator **170** may be coupled to sheath **124** and include internal stops for limiting movement of the sheath **124** relative to the tool **122**. A drive member (not shown) may be fixed to proximal end **162** of the tool handle assembly **160**. It is understood that the tool handle assembly **160** may be formed in any conventional manner to control the movement of tool **122** relative to the sheath **124**.

Tool handle assembly **160** may be mounted in other suitable locations and/or in other orientations with respect to handle **102**. In the example shown in FIGS. **1**, **2**, and **4**, tool handle assembly **160** is mounted on mounting surface **159** such that, when mounted, tool handle assembly **160** does not affect an operator's ability to access and grasp handle **102** via ergonomic gripping portion **156**.

In some aspects of the present disclosure, the tool **122** may comprise an end effector **120**, such as a basket as shown in FIG. **1**. For example, the tool **122** may be a basket device configured to capture stones and other materials. Any other suitable tools may be used according to the present disclosure, including, but not limited to, forceps, scissors, a grasper, a snare, a probe, and/or other tools. Tools may comprise materials such as metals, metal alloys, shape memory materials, polymers (including plastics and thermopolymers), or any combinations thereof. Tool **122** may also be a laser fiber. The proximal end of the laser fiber may be connected to an energy source, such as a Holmium laser, for example. When the laser is activated, optical (laser) energy may travel from the proximal end of the fiber to a distal end of the fiber and into the body to treat, e.g., a kidney stone.

The basket (or other expandable end effector) may be configured to self-expand, e.g., having a compressed configuration within the sheath **124** (or a laser fiber or basket device) and an expanded configuration outside the sheath **124**, such that, in the expanded configuration past the distal

end **108** of the shaft **104** and once deployed outside of sheath **124**, the basket may be used to retrieve materials and objects captured within the basket. For example, the inner surface of the sheath **124** may serve to compress the basket. In some cases this may help to minimize the size of the medical device **100**. For example, according to some aspects, the basket may have a cross-sectional diameter ranging from about 0.5 Fr (0.17 mm) to about 1.5 Fr (0.5 mm), e.g., about 1 Fr (0.33 mm), and the working channel **112** may have a cross-sectional diameter ranging from about 1 Fr (0.33 mm) to about 2 Fr (0.67), e.g., about 1.5 Fr (0.5 mm).

In some aspects, the basket may include a wire, e.g., a wire filament that splits into three, four, or more wires in a generally bulbous shape that converge at the tip. Additionally or alternatively, the basket may comprise a mesh or net-like portion towards the proximal end of the basket, e.g., to capture relatively smaller pieces of materials, such as pulverized stone. Further, for example, the basket may be configured as a net, e.g., comprising a mesh, to facilitate the retrieval of small fragments of material. A guidewire and/or laser may be inserted into one of the working channels, e.g., working channel **110** or **114**, during a procedure. For example, a laser may be used to break apart relatively larger pieces of materials within the body to facilitate removal of the material with the basket.

The basket may include Nitinol or other suitable flexible materials. For example, the basket may include Nitinol such that the basket is self-expandable. Alternatively, the basket may be configured to expand manually once extended beyond the distal end of the sheath **124**, e.g., via a suitable control mechanism in the tool handle assembly **160**.

Sheath **124** containing tool **122** may extend distally from the distal end **164** of tool handle assembly **160**, through working channel **112**, and out of the distal end **108** of shaft **104**. The longitudinal translation of sheath **124** may be controlled by medical device **100** via a translation system **180**. Translation system **180** may be a belt and pulley system comprising an endless belt **182** driven by a thumbwheel **184** that rotates about a point **185** disposed within proximal end **101** of handle **102**. The thumbwheel **184** may be configured as a driving wheel of the belt and pulley translation system **180**, which, through one or more intermediate rollers **186** and/or gears (not shown in the examples of FIGS. **1-4**), is configured to control, urge, or cause, the longitudinal movement of sheath **124** via a pair of friction rollers **186** and **188**. Any suitable number of rollers and/or gears may be utilized in any configuration in order to convert a rotational force applied to thumbwheel **184** into the longitudinal movement of tool **122** and sheath **124**.

Friction rollers **186** and **188** may be disposed in a translation housing **190**, and may be positioned adjacent one another such that a very small distance is disposed between friction rollers **186** and **188**. It is also contemplated that there may be no distance between friction rollers **186** and **188**. Friction rollers **186** and **188** may include a high-friction material, e.g., rubber, along their respective circumferences. The rubber material of friction roller **186** may contact the rubber material of friction roller **188**. Friction rollers **186** and **188** may be biased toward one another by, e.g., an elastic biasing member. Sheath **124** may be positioned between friction rollers **186** and **188** such that the rotation of rollers **186** and **188** moves sheath **124** in a longitudinal direction. The high-friction material may promote the longitudinal movement of sheath **124** positioned between the friction rollers **186** and **188**. Translation system **180** may be configured that when thumbwheel **184** is rotated in a first direction (e.g., clockwise), rollers **186** and **188** may rotate

and cause sheath **124** to move distally relative to shaft **104**. Thumbwheel **184** may be rotated in a second direction that is opposite of the first direction (e.g., counterclockwise) to urge or cause rollers **186** and **188** to move proximally relative to shaft **104**.

Rollers **186** and **188** may rotate simultaneously in opposite directions to effect longitudinal movement of sheath **124**. For example, in the example shown in FIG. **4**, roller **186** may rotate in a clockwise direction while roller **188** rotates in a counterclockwise direction in order to move sheath **124** distally relative to shaft **104**. In the same example of FIG. **4**, roller **186** may rotate in a counterclockwise direction while roller **188** rotates in a clockwise direction in order to move sheath **124** proximally relative to shaft **104**. Other suitable arrangements are also contemplated based upon the relative positioning of translation housing **190** and handle **102**. For example, roller **186** may rotate in a clockwise direction while roller **188** rotates in a counterclockwise direction in order to move sheath **124** proximally, as opposed to distally, relative to a different shaft and vice versa.

Belt **182** of translation system **180** may be sufficiently tensioned in order to maintain and lock the position of tool **122** when no force is applied to thumbwheel **184**. This may help maintain the position of tool **122** within the body without requiring active input from the operator. That is, once the tool **122** is placed in a desired position, the operator may utilize his or her hand which was manipulating thumbwheel **184** to manipulate other devices.

In some examples, thumbwheel **184** may be replaced by a gear driven by a motor. The motor may be actuated by a switch or other mechanism which may be disposed on the outer surface of handle **102**, for example, on thumbwheel surface **154**. In one example, the switch may be a sliding switch with intuitive and/or tactile feedback. For example, the switch may be configured such that when it is pushed in the distal direction, tool **122** and sheath **124** may be moved distally. When the switch is pulled proximally, tool **122** and sheath **124** may be pulled proximally. The switch may be pressure-sensitive, and may control the output of the motor based on the amount of pressure applied to the switch by the operator. Thus, the tool **122** and sheath **124** may be moved at a faster rate when more pressure is applied to the switch.

FIGS. **5** and **6** depict a medical device **500** that is substantially similar to medical device **100** described above, except that medical device **500** may include a translation system **580** instead of translation system **180**. Translation system **580** may be a belt and pulley system comprising an endless belt **582** driven by a thumbwheel **584** that rotates about a point **585** disposed within proximal end **101** of handle **102**. The thumbwheel **584** may be configured as a driving wheel of the belt and pulley translation system **580**, which, through one or more intermediate rollers **586** and/or gears **587**, is configured to control the longitudinal movement of sheath **124** via a pair of friction rollers **586** and **588**. Friction rollers **586** and **588** may operate in a substantially similar manner as rollers **186** and **188** described above in order to move sheath **124** longitudinally. Friction rollers **586** and **588** may be driven directly by a gear **599** that is coupled to one of rollers **586** and **588** instead of being driven directly by belt **582**. In one example, gear **599** may be coaxial with one of rollers **586** and **588**. Friction rollers **586** and **588** may be disposed in a translation housing **590**, which may extend from gripping portion **156** of handle **102**. Translation housing **590** may include one or more mating flanges **592** that may be received by corresponding mating features **594** that extend from a surface of gripping portion **156**. Mating

flanges **592** and mating features **594** may form a tongue and groove joint. Translation housing **590** also may be configured to mount to a surface of handle **102** in any other suitable manner.

A medical device **700** is shown in FIGS. **7** and **8**. Medical device **700** may include an endoscopic device **702** coupled to a translation device **704**. Endoscopic device **702** may include a shaft **706** (e.g., a rigid or semi-rigid shaft), and an elongate member **708** that extends distally from the distal end of shaft **706**. Elongate member **708** may be the portion of endoscopic device **702** that is configured to be inserted into a patient. Elongate member **708** may include an opening **710** at its proximal end that is configured to receive a fiber **711**, e.g., a laser fiber **711**. Opening **710** may receive other objects, such as, e.g., tool **122** and sheath **124**.

Translation device **704** may include a housing **712** and a mating section **714** that extends from housing **712**. Mating section **714** may be formed as a split tube that is configured to wrap around a shaft of an endoscopic member, such as, e.g., shaft **706**. Mating section **714** may include a longitudinal opening **715** that extends along a substantial entirety of the length of mating section **714**. The opening **715** may allow the split tube to be placed around the shaft **706**. Once disposed around the shaft **706** of endoscopic member **702**, mating section **714** may be secured to the shaft **706** in any suitable manner, such as, e.g., friction fits, clamps, or the like. Mating section **714** may be rigid such that mating section **714** is snapped onto shaft **706**. In other examples, mating section **714** may be flexible and may be wrapped around the shaft **706**.

Fiber **711** may extend through housing **712** via one or more apertures and lumens. The longitudinal translation of fiber **711** through endoscopic device **702** may be controlled by translation device **704** via a translation system **780**. Translation system **780** may be any suitable system configured to convert a rotational force applied to a thumbwheel **716** to move fiber **711** longitudinally. In the example shown in FIGS. **7** and **8**, thumbwheel **716** may be a gear that drives a gear **782**. Gear **782** may be coupled to a friction roller **784**. Friction roller **784** may engage fiber **711** and apply a tension to fiber **711** along with an interior surface **786** of housing **712**. Fiber **711** may be positioned between friction roller **784** and surface **786** such that the rotation of roller **784** moves fiber **711** in a longitudinal direction. Translation system **780** may be configured such that when thumbwheel **716** is rotated in a first direction (e.g., clockwise), roller **784** may rotate and cause fiber **711** to move distally relative to shaft endoscopic device **702**. Thumbwheel **716** may be rotated in a second direction that is opposite of the first direction (e.g., counterclockwise) to cause fiber **711** to move proximally relative to endoscopic device **702**.

In some examples, a locking mechanism may fix the position of laser fiber **711** relative to a tip of endoscopic device **702** in a hands-free fashion. Thus, mating section **714** may be fixed to the shaft **706** with a slip fit using a suitably high friction material (like silicone) that would enable the device to remain stationary under nominal conditions. Thumbwheel **716** then may actuate a locking mechanism to fix the laser fiber position. As set forth above, this may be a friction-based mechanism. Alternatively, thumbwheel **716** may permit stability under nominal conditions and limit translation along shaft **706** to provide limited (e.g., fully manual) advancement of fiber **711** relative to the tip of endoscopic device **702**.

Examples of the present disclosure may reduce the number of operators needed to complete various procedures by allowing a single operator to control a tool disposed through

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an endoscopic member. In the case of laser treatments, examples of the present disclosure may help prevent the laser from firing in the wrong direction when, for example, the user inadvertently moves thereby changing the firing position of the laser. This may help prevent damage to imaging devices by the laser. 5

Other examples of the present disclosure will be apparent to those skilled in the art from consideration of the specification and practice of the examples disclosed herein. While certain features of the present disclosure are discussed within the context of exemplary procedures, the devices, instruments, and methods are not so limited and may be used in other areas of the body, and for other medical procedures according to the general principles disclosed. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the present disclosure being indicated by the following claims. 10 15

We claim:

1. A medical device, comprising:

- a handle having a thumbwheel that extends through an outer surface of the handle and a gear that extends from a body of the handle and through the outer surface of the handle; 20
- a shaft coupled to the handle, the shaft including a working channel;

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a sheath disposed through the working channel;
a tool disposed through the sheath and movable relative to the sheath;

a tool handle assembly mounted to the handle, the tool handle assembly having an actuator configured to move the tool relative to the sheath; and

a pair of friction rollers positioned entirely outside the body of the handle and operatively coupled to the gear, wherein the pair of friction rollers is configured to be actuated by the thumbwheel, wherein the pair of friction rollers receive the sheath between one another, and wherein rotation of the thumbwheel causes the gear to rotate, thereby causing the pair of friction rollers to rotate and urge the sheath and the tool to move through the working channel.

2. The medical device of claim 1, wherein rotation of the thumbwheel in a first direction causes the sheath and the tool to move distally together, and wherein rotation of actuator in a second direction that is opposite of the first direction causes the sheath and the tool to move proximally together.

3. The medical device of claim 1, further comprising a second gear operatively coupled to the pair of friction rollers, wherein the second gear operatively couples to the gear on the outer surface of the handle.

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